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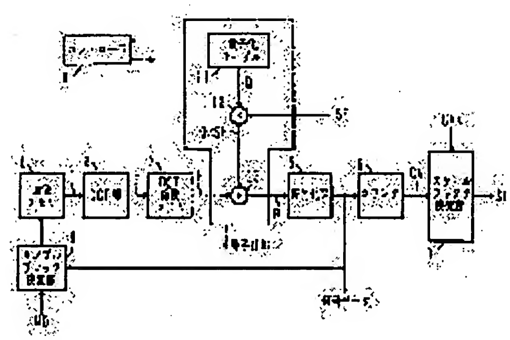
(71)Applicant : **FUJI FILM MICRO DEVICE KK**
FUJI PHOTO FILM CO LTD
(72)Inventor : **YASHIMA HIDEAKI**

(54) SAMPLE BLOCK DECISION SYSTEM AND SAMPLE BLOCK DECISION METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To decide a sample block corresponding to the kind of pictures by providing a means for performing spatial frequency analysis for respective blocks for the pictures composed of the plural blocks and selecting and deciding the sample block from the plural blocks for constituting the pictures corresponding to spatial frequency distribution.
SOLUTION: A DCT part 2 performs a DCT processing for the picture data I of a block unit and obtains a DCT coefficient F. For the DCT coefficient F, a spatial frequency component becomes higher from the upper left to the lower right of a matrix. An encoding part 5 performs run-length encoding, then performs Huffman encoding and generates code data and the code data are supplied to a sample block decision part 9 and a counter 6. The sample block decision part 9 receives the code data from the encoding part 5 and counts and stores a code data amount for the respective blocks. Then, the code data amount of the block unit for all the blocks of the pictures of one frame is stored and the sample block is decided based on it.



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CLAIMS

[Claim(s)]
[Claim 1] The sample block decision system which has the block decision means which carries out a spatial frequency analysis for every block about the image which consists of two or more blocks, and makes a selection decision of the sample block out of two or more blocks which constitute an image according to a spatial-frequency-analysis means to search for spatial-frequency distribution of an image, and spatial-frequency distribution of said image.
[Claim 2] Said block decision means is a sample block decision system according to claim 1 which is a means to determine the block containing the component of much far-reaching spatial frequency as a sample block.
[Claim 3] Said block decision means is a sample block decision system according to claim 1 which is a means to choose one from the patterns of two or more sample blocks according to spatial-frequency distribution of said image.
[Claim 4] Said spatial-frequency-analysis means is a sample block decision system according to claim 1 to 3 which is a means to search for spatial-frequency distribution only about the block chosen in the block which constitutes an image.
[Claim 5] Said spatial-frequency-analysis means is a sample block decision system according to claim 1 to 4 which performs a discrete cosine transform and searches for spatial-frequency distribution.
[Claim 6] Said spatial-frequency-analysis means is a sample block decision system according to claim 5 which quantizes so coarsely [after performing a discrete cosine transform] that a spatial-frequency component is high, and searches for spatial-frequency distribution.
[Claim 7] The sample block decision system which has a mode assignment means for specifying the mode which shows the class of image, and a block decision means to choose one from the patterns of two or more sample blocks according to said mode.
[Claim 8] Furthermore, the sample block decision system according to claim 1 to 7 which has a statistics processing means to calculate the amount of code data about said sample block, and to determine the condensation of an image, and a compression means to carry out the data compression of the image with said condensation, and to generate code data.
[Claim 9] The sample block decision approach including the process which carries out a spatial frequency analysis for every block about the image which consists of two or more blocks, and makes a selection decision of the sample block out of two or more blocks which constitute an image according to the process which searches for spatial-frequency distribution of an image, and spatial-frequency distribution of said image.
[Claim 10] The sample block decision approach including the process for specifying the mode which shows the class of image, and the process which chooses one from the patterns of two or more sample blocks according to said mode.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the technique of determining a sample block out of the block which constitutes a digital image, about digital image processing.
[0002]
[Description of the Prior Art] In case a digital image is processed, a digital image may be divided into two or more blocks, and may be processed per block. For example, compression of a JPEG (joint photographic expertgroup) method processes a digital static image per 8x8-pixel block, and generates code data.
[0003] In case an image processing is performed, only the case where all blocks are processed, and a sample block may be processed. A sample block is a block by which a sample is carried out out of a whole block.
[0004] For example, in case the code data of an image is generated, compression processing is performed about all blocks and code data is generated. On the other hand, statistics processing of an image etc. may be processed about not all blocks for shortening of the processing time etc., in case the class of image is judged, but only a sample block may be processed, and the class of image may be judged.
[0005] Next, although a sample block is used, a digital still camera is explained as an example. A digital still camera photos a digital static image by turning a lens to a photographic subject and pushing a shutter carbon button. The data compression of the image by which image formation is carried out through a lens is changed and carried out to an electrical signal, and it is memorized by the memory card which can be renewed. A data compression reduces the amount of data, and it is performed in order to make a memory card memorize many image data.
[0006] The amount of the code data obtained by carrying out the data compression of the digital image changes with spatial-frequency distribution which a digital image has. For example, the amount of code data can seldom be lessened about the digital image containing many high frequency components. On the other hand, about a digital image with few high frequency components, the amount of code data can be lessened considerably. That is, although it changes with methods of a data compression, the amount of the code data generally generated by the data compression changes with classes of digital image.
[0007] The code data by which the data compression was carried out is memorized by storages, such as a memory card. A memory card has the memory capacity of 1 M byte, and cannot make 1 M bytes or more of data memorize in that case.
[0008] In order to make it not write code data in a memory card more than 1 M byte, it is necessary to tell a photography person about the remaining number of sheets recordable for a photography person's facilities. The code data by which a data compression is carried out is not based on the class of digital image, but if it is all the same amount of data per each image, a photography person can be easily told about the number of sheets of a digital image recordable on a memory card.
[0009] However, when the amount of code data is adjustable, a photography person cannot be told about

the remaining number of sheets. If there are few amounts of code data of the image to be photoed from now on, many number of sheets is recordable, and if there are many amounts of code data of the image to photo, only small number of sheets is recordable.
[0010] So, in case the data compression of the digital image is carried out, to perform fixed-length-ized processing of code data is desired. By performing fixed-length-ized processing, even if it is what kind of digital image, it is convertible for the code data of about 1 quantum. Fixed-length-ized processing is processing for carrying out the data compression of the digital image of one sheet (one frame), and generating fixed-length code data. If code data is a fixed length, a photography person can be easily told about the remaining number of sheets.
[0011] Next, fixed-length-ized processing is explained. In order to perform fixed-length-ized processing, statistics processing is first performed as pretreatment, the condensation of a data compression is adjusted according to the result of the statistics processing, and fixed-length code data is generated.
[0012] A photography person's push of a shutter carbon button incorporates a digital image. Next, statistics processing is performed to the incorporated digital image. Statistics processing is processing which guesses statistically the code data of the amount of which about is generated, when it compresses about the incorporated digital image.
[0013] A sample block is used in case this statistics processing is performed. Statistics processing is processing which estimates the near amount of code data, and does not necessarily need to estimate the exact amount of code data. Moreover, in order to perform an exact estimate, generally the long processing time is needed. An advantage has more direction which performs a near estimate rather for a short time rather than processing long duration and performing an exact estimate in fact.
[0014] If a more exact estimate is performed, it is necessary to perform statistics processing about all blocks. What is necessary is near to perform statistics processing only about a sample block to process for a short time, since it estimates and is easy to come out.
[0015] Drawing 19 (A) and (B) are blocks with which the block which the image of one sheet showed that it was constituted by two or more two-dimensional blocks, and expressed with the slash serves as a processing object. Drawing 1919 (A) shows that all blocks of the image of one sheet are processing objects.
[0016] Drawing 19 (B) shows the example of a sample block. A sample block is arranged in the shape of a checker board (hound's-tooth check) in the image of one sheet, and the sample block is alternately arranged about the lengthwise direction and the longitudinal direction in the whole block.
[0017] Termination of statistics processing performs compression processing and storage processing. as a result of statistics processing, more code data are generated and meet -- what is necessary is just to compress by setting up condensation more highly, if it is surmised that it comes out code data is generated fewer and meets -- what is necessary is just to compress by setting up condensation lowness, if it is surmised that it comes out The code data generated by the data compression serves as the always almost fixed amount of data.
[0018] Then, the code data by which the data compression was carried out is recorded on a memory card etc. by storage processing. Above, a series of processings to the record from incorporation of a digital image to a memory card etc. are ended.
[0019]
[Problem(s) to be Solved by the Invention] The block count is the one half of the number of whole blocks of an image, and the sample block shown in drawing 19 (B) is mostly arranged over the whole image at homogeneity. Generally the contiguity block in an image has a similar image pattern in many cases. Therefore, the description of all images could be mostly grasped, even if it adopts the block in every other one.
[0020] If statistics processing is performed only about a sample block, the time amount of statistics processing will be shortened. However, the precision of statistics processing falls to cases -- the sample of the boundary which is the backbone of image information is not carried out. Then, how the pattern and the block count of a sample block should be set up poses a problem. According to the conventional technique, the class of image was not made into the problem but statistics processing was performed

using the sample block of the same pattern.
[0021] Even if it is the same image, depending on how to choose the pattern of a sample block, it may become larger than the target amount of code data, or may become small. However, since the maximum memory capacity was decided, neither a memory card nor a floppy disk can memorize more amounts of code data than the capacity. Therefore, it is not desirable that quite more code data than desired value are generated.
[0022] The purpose of this invention is offering the sample block decision system which can determine a sample block according to the class of image. Other purposes of this invention are offering the sample block decision approach the pattern of a sample block being decided, according to the class of image.
[0023]
[Means for Solving the Problem] It has the block decision means which carries out the spatial frequency analysis of the sample block decision system of this invention for every block about the image which consists of two or more blocks, and makes a selection decision of the sample block out of two or more blocks which constitute an image according to a spatial-frequency-analysis means to search for spatial-frequency distribution of an image, and spatial-frequency distribution of said image.
[0024] An image consists of two or more blocks. A spatial frequency analysis is carried out for each [which constitutes an image] the block of every, and spatial-frequency distribution of an image is searched for. Spatial-frequency distribution of an image shows the property of the image. A selection decision of the sample block is made out of the block which constitutes an image by making to include many high frequency components from a predetermined value into a criterion, corresponding to this spatial-frequency distribution. A sample block will be determined according to the class of image.
[0025] Moreover, the sample block decision system of this invention has a mode assignment means for specifying the mode which shows the class of image, and a block decision means to choose one from the patterns of two or more sample blocks according to said mode.
[0026] The pattern of two or more sample blocks is prepared beforehand. According to the mode which shows the class of image, one is chosen from the patterns of two or more sample blocks. According to the mode, as for a sample block, one will be chosen from two or more patterns.
[0027] The sample block decision approach of this invention includes the process which carries out a spatial frequency analysis for every block about the image which consists of two or more blocks, and makes a selection decision of the sample block out of two or more blocks which constitute an image according to the process which searches for spatial-frequency distribution of an image, and spatial-frequency distribution of said image.
[0028] Moreover, the sample block decision approach of this invention includes the process for specifying the mode which shows the class of image, and the process which chooses one from the patterns of two or more sample blocks according to said mode.
[0029]
[Embodiment of the Invention] Drawing 1 is the block diagram showing the picture compression structure of a system containing the sample block decision system by the example of this invention. This picture compression system generates the code data based on the JPEG method which is a standard compression method of a digital static image. The resource of the system of the conventional JPEG method is utilizable as it is.
[0030] A picture compression system has an image memory 1, the discrete cosine transform (henceforth DCT) section 2, the DCT coefficient memory 3, the quantization section 4, the coding section 5, a counter 6, the scale-factor decision section 7, the sample block decision section 9, and a controller 8. A controller 8 delivers a timing signal among other the processing blocks of all, and adjusts the timing during a processing block.
[0031] Next, each processing block is explained. Image memories 1 are DRAM and a flash memory, and memorize the image data of one frame. In the image memory 1, image data is usually memorized in the raster format. Image data consists of two or more pixel data.
[0032] Raster formats are the following pixel data lists about the image of one frame. First, it begins from the pixel of the upper left corner of an image, and stands in a line one by one toward a right

horizontal direction. If it carries out to a right end pixel, it will begin from the pixel at the left end of next Rhine, and will stand in a line one by one toward a right horizontal direction. Hereafter, it carries out to Rhine under No. 1 similarly. The pixel of a lower right corner serves as the last data.
[0033] Since a picture compression system processes fundamentally in the block unit which consists of 8x8 pixels, an image memory 1 changes image data into a block type from a raster format, and supplies it to the DCT section 2. Monochrome image consists of one kind of image data. A color picture consists of brightness data and color data, and the raster / block conversion of each data are carried out as another image data.
[0034] Block types are the following pixel data lists about the image of one frame. Field division of the image of one frame is carried out at two or more blocks. 1 block is 8x8 pixels. Like the above-mentioned raster format, the sequence of the block in one frame begins from the block of an upper left corner, and is located in a line with a right horizontal direction. If a right end is arrived at, it will move to the list of the following block and will rank with the right from the left. Hereafter, the same list is repeated. The last block is a block of a lower right corner.
[0035] The pixel data list within a block is the same as that of a raster format too, begins from the pixel data of the upper left corner within a block, and is located in a line with a right horizontal direction. If a right end is arrived at, it will move to next Rhine. The last pixel data are pixel data of the lower right corner within a block.
[0036] An image memory 1 supplies image data I about a predetermined block to the DCT section 2 according to the signal from the sample block decision section 9. The sample block decision section 9 can also direct the output of all blocks to an image memory 1, and can also direct the output of a sample block of a predetermined pattern to an image memory 1.
[0037] Image data I of a predetermined block is supplied to the DCT section 2. The following processings are performed considering 1-block image data as one unit. That is, JPEG compression divides the image of one sheet into the block of a large number whose each is 8x8 pixels, and carries out the following processings to each block unit.
[0038] The DCT section 2 performs DCT processing about image data [of a block unit] I. DCT processing is the transposition cosine coefficient matrix Dt about image data I. The DCT multiplier F is obtained by inserting by the cosine coefficient matrix D and performing matrix operation.
[0039] F=Dt ID [0040] Drawing 2 is the matrix of 8x8 showing the DCT multiplier F. When image data I is 8x8 pixels, the DCT multiplier F can be displayed in procession of 8x8. The DCT multiplier F carries out the spatial frequency analysis of the information on image data I, and Fi0 by which F00 of the upper left also shows the component of the direct current also to a lengthwise direction to a longitudinal direction, and goes to a longitudinal direction serves as information which shows a high frequency component gradually about a longitudinal direction. F0j which goes to a lengthwise direction becomes the information which shows a high frequency component gradually about a lengthwise direction. For image information, it is as important information as a low-frequency component, and a high frequency component serves as noise-information.
[0041] Drawing 3 is a matrix which shows the example of the DCT multiplier F generated by carrying out DCT processing of the general image data I. The DCT multiplier F which return and the DCT coefficient memory 3 are DRAM and SRAM, and is generated by drawing 1 in the DCT section 2 is memorized.
[0042] Next, the configuration of the quantization section 4 is explained. Memory 11 memorizes the quantization table Q. Drawing 4 shows the example of the quantization table Q. As mentioned above, since a picture compression system performs a data compression per block of 8x8, the quantization table Q is constituted by the matrix of 8x8 corresponding to it.
[0043] The quantization table Q is a quantization table for performing a data compression with standard condensation. Quantization processing does a division to the DCT multiplier F of 8x8 by the multiplier to which it corresponds in the quantization table Q. A DCT multiplier has a low spatial-frequency component, and its spatial-frequency component is as high as the direction of the upper left of a matrix as the direction of the lower right. The basis child-ized table Q is as fine as a frequency component low

as a whole, and it is shown that a higher frequency component quantizes coarsely. Generally, a data compression is performed by deleting the information on the high frequency component of image data in consideration of a high frequency component having many noises in consideration of human being's vision property.
[0044] Return and a multiplier 12 multiply the quantization table Q by the scale factor SF at drawing 1 . That is, all the elements of the matrix of the basis child-ized table Q are multiplied by the scale factor SF. A multiplier 12 outputs SF-Q.
[0045] A scale factor SF is equivalent to the condensation of code data. It is shown that condensation is so large that a scale factor SF is large, and it is shown that condensation is so small that a scale factor SF is small.
[0046] SF-Q is supplied to a divider 13. A divider 13 outputs the quantization data Ruv in which the DCT multiplier Fuv memorized by the DCT coefficient memory 3 is divided into by quantization table SF-Quv, and is shown by the bottom formula. Rolling round means integer-ization to the nearest integer.

[0047]
Ruv=round [Fuv/(SF-Quv)]
[0048] Drawing 5 shows the quantization data R obtained by quantizing the DCT multiplier F shown in drawing 3 . However, a scale factor SF is 1.
[0049] Return and the coding section 5 perform coding processing to drawing 1 to the quantization data Ruv. Coding processing includes processing of run length coding and Huffman coding. Run length coding can perform high compression to data with which the value of 0 continues continuously.
[0050] As shown in drawing 5 , for the quantization data Ruv, many 0 is an assembly and a cone to the lower right part (high frequency component) of a matrix. High compression can be performed if run length coding is performed for the matrix Ruv of quantization data with a zigzag scan using this property.
[0051] Drawing 6 shows how to carry out the zigzag scan of the quantization data Ruv. The element of the quantization data R is equivalent to the element of the DCT multiplier F, and R00 of the upper left also shows the component of a direct current to a longitudinal direction also in a lengthwise direction. Ri0 which goes to a longitudinal direction serves as information which shows a high frequency component gradually about a longitudinal direction, and R0j which goes to a lengthwise direction becomes the information which shows a high frequency component gradually about a lengthwise direction.
[0052] A zigzag scan is the approach of scanning each element in order of the arrow head of drawing, and is the approach of carrying out a sequential scan towards a high frequency component from a low-frequency component. High compression can be performed for the data with which 0 continues continuously, and, as for run length coding, in other words, the data which generally contain many 0 can perform high compression.
[0053] If run length coding is performed with a zigzag scan, generally the amount of code data generated will decrease, so that there are many zero in the matrix of the quantization data R. That is, when only the data of few frequency components are contained in the quantization data R, the amount of code data decreases, and when the data of all frequency components are contained, the amount of code data increases comparatively.
[0054] In addition, as shown, for example in drawing 5 , it is tended for the quantization processing performed by pre- processing to be as fine as a low-frequency component, and, as for the quantization data R, to set a high frequency component to zero from a low-frequency component, since a high frequency component quantizes more coarsely. The quantization data R tend to contain many elements of 0, and the amount of code data of the image with few high frequency components tends to decrease by run length coding.
[0055] After return and the coding section 5 perform run length coding to drawing 1 , they perform Huffman coding and generate code data to it. Code data is supplied to the sample block decision section 9 and a counter 6. Moreover, finally code data is supplied to storages, such as a memory card and a

floppy disk, and is memorized.
[0056] The sample block decision section 9 counts and memorizes the amount of code data for every block in response to code data from the coding section 5. Code data is supplied to the sample block decision section 9 in a block unit from the coding section 5. The sample block decision section 9 memorizes the amount of code data of the block unit about all blocks of the image of one frame, and determines a sample block based on the amount of code data concerned. The detailed decision approach is explained later. An image memory 1 supplies image data I to the DCT section 2 only about the sample block determined by the sample block decision section 9.
[0057] In addition, the sample block decision section 9 can also determine a sample block according to mode signal MD which is not based on the amount of code data, or is supplied from the outside with the amount of sign days. The class of image shows mode signal MD and it is explained later for details.
[0058] A counter 6 counts the amount valve flow coefficient of the code data of the whole block generated in the coding section 5. The image of one frame consists of n blocks. Since code data is generated per block, a counter 6 computes the amount (henceforth code volume) valve flow coefficient of the code data of the image of one frame by accumulating the amount of the code data of all blocks (n blocks).
[0059] The code volume valve flow coefficient is supplied from a counter 6, and also the target code volume CVx is supplied to the scale-factor decision section 7 from the exterior. The target code volume CVx is the amount of the code data generated about the image of one frame which a user or a system desires.
[0060] The scale-factor decision section 7 determines the scale factor SF which should be supplied to the quantization section 4 based on the code volume valve flow coefficient and the target code volume CVx which were counted. When there is more code volume valve flow coefficient than the target code volume CVx, a scale factor SF is set up more greatly, and when there is less code volume valve flow coefficient than the target code volume CVx, a scale factor SF is set up more smallish.
[0061] A scale factor SF shows condensation, it is adjusted in order to generate the code data of the target code volume CVx, and it is supplied to the quantization section 2. Statistics processing will be ended if a scale factor SF can be found. Termination of statistics processing generates final code data using a scale factor SF.
[0062] Drawing 7 is a flow chart which shows the procedure which the picture compression system by this example performs. A picture compression system performs fixed-length-ized processing and generates code data. The target code volume fixed-length-ized is CVx.
[0063] Sample block decision processing is performed at a step SA 1. First, the code data of the whole block of the image of one frame is generated, and the amount of code data for every block is calculated. A sample block is determined according to the amount of code data concerned. The sample block decision section 9 of drawing 1 directs the pattern of a sample block to an image memory 1. The detail of decision processing of a sample block is explained referring to drawing 8 behind.
[0064] At a step SA 2, statistics processing is performed about a sample block. In drawing 1 , an image memory 1 outputs image data I only about the sample block directed from the sample block decision section 9. Code data is generated, after DCT processing of the image data I is carried out in the DCT section 2, quantizing by scale-factor SF=1 in the quantization section 4 and quantizing in the coding section 5.
[0065] A counter 6 accumulates the amount of code data of a sample block. The scale-factor decision section 7 compares the amount of code data concerned with the target code volume CVx, and presumes and outputs the more desirable scale factor SF. Since the target code volume CVx is the amount of code data of one frame (whole block), a scale factor SF is searched for so that it may convert into the amount of code data of the block count of a sample block of the target code volume CVx and the amount of code data which the counter 6 counted may approach the converted amount of code data.
[0066] For example, when there is more code volume valve flow coefficient than the target code volume CVx, a scale factor SF is set as a value smaller than 1, and when there is less code volume valve flow coefficient than the target code volume CVx, a scale factor SF is set as a larger value than 1.

[0067] In addition, a scale factor SF can be searched for by various statistics arts. For example, after performing multiple-times compression rather than performing compression for image data once, a scale factor SF may be searched for.
[0068] At a step SA 3, formal compression processing is performed using the scale factor SF determined by statistics processing. The scale factor SF determined in the scale-factor decision section 7 is supplied to the quantization section 4. A picture compression system performs the data compression of a whole block using the new scale factor SF.
[0069] First, an image memory 1 outputs image data I of a whole block. DCT processing of the image data I is carried out in the DCT section 2, and it quantizes in the quantization section 4, and code data is generated after encoding in the coding section 5.
[0070] The code data concerned is final code data, and the code volume becomes a thing near the target code volume CVx. If the code data of the image of one frame is generated, fixed-length-ized compression processing will be ended.
[0071] Drawing 8 is a flow chart which shows the 1st example of sample block decision processing of the step SA 1 of drawing 7 . At a step SB 1, block number m is set as 1. At a step SB 2, block [m-th] image data is compressed and code data is generated. That is, DCT processing of the block [m-th] image data memorized in the image memory 1 is carried out in the DCT section 2, and it quantizes in the quantization section 4, and encodes in the coding section 5, and code data is generated. The scale factor SF at the time of quantizing is 1.
[0072] At a step SB 3, the amount of block [m-th] code data is calculated. The sample block decision section 9 counts and memorizes the amount of the generated block [m-th] code data.
[0073] At a step SB 4, it investigates whether block number m is last block number n. The image of one frame consists of the 1st block at the n-th block. When block number m is not last block number n, in order to process the following block, it progresses to a step SB 5.
[0074] At a step SB 5, block number m is incremented and it returns to a step SB 2. At a step SB 2, the code data of the following block number m is generated, and the amount of the code data is counted and memorized in a step SB 3. These processings are repeated to last block number n, and are performed.
[0075] After processing of last block number n is completed, in a step SB 4, it is judged that block number m is last block number n, and it progresses to a step SB 6. At a step SB 6, a sample block is determined according to the amount of code data for every block, and processing is ended. For example, the block with more amounts of code data than a predetermined value is determined as a sample block.
[0076] Drawing 9 (A) and (B) are two-dimensional images which consist of 3x5 blocks, and show the amount of code data, and the relation of a sample block. Drawing 9 (A) shows the example of the amount of code data of each 3x5-block block. Drawing 9 (B) shows with a slash the block adopted as a sample block in 3x5 blocks.
[0077] Drawing 9 (A) shows the example in which an image has the different amount of code data for every block. In these blocks, for example, the amount of code data adopts only 50 or more things as a sample block. As for drawing 9 (B), the amount of code data shows 50 or more blocks with a slash. The block which gave the slash concerned is determined as a sample block.
[0078] A predetermined value is not limited to 50 but can be made into any value. If a predetermined value is enlarged, the number of sample blocks will decrease. If a predetermined value is made small, the number of sample blocks will increase.
[0079] Drawing 10 (A) and (B) show the image of the sample block determined about a portrait image. If sample block decision processing is performed about a portrait image as shown in drawing 10 R> 0 (A), it will be expected that a sample block as shown in drawing 10 (B) is determined. Drawing 10 (B) corresponds to drawing 10 (A), the image which consists of two or more two-dimensional blocks is shown, and the block which gave the slash shows a sample block. The field where a person exists tends to become a sample block.
[0080] Fields other than the field which shows a person are backgrounds in many cases. A background is a field which hardly contains an image with little change, i.e., a high frequency component, like empty. Moreover, since the focus of an image suits the person in many cases, a background serves as an

image which faded and hardly contains a high frequency component too. Since a background hardly contains a high frequency component for the above-mentioned reason, the amount of code data tends to decrease. Consequently, it is hard to be adopted as a sample block.
[0081] On the other hand, since the focus suits a person's field, it tends to contain many high frequency components. Since image data is the part which changes rapidly spatially, a person's profile contains a high frequency component. A high frequency component is included by existence of opening, a nose, etc. about the person itself. Since code data tends to increase including a high frequency component, a person's field is easy to be adopted as a sample block.
[0082] The amount of code data of the block containing a wide range frequency component increases. This will be called if activity is large. The amount of code data of the block which, on the other hand, contains only frequency components of the limited range, such as a low-frequency component, decreases. This will be called if activity is small.
[0083] In drawing 1 , the sample block decision section 9 investigates the activity of each block, and determines the large block of activity as a sample block. Other approaches may be used although how to investigate the amount of the code data which the coding section 5 generates as an approach of investigating activity was shown above.
[0084] For example, the activity for every block may be investigated from the DCT multiplier F generated in the DCT section 2, and the activity for every block may be investigated from the quantization data R generated in the quantization section 4. It can ask for activity by carrying out a spatial frequency analysis by DCT processing etc.
[0085] If statistics processing is performed about a sample block, the scale factor SF in case a sample block is a block of the average activity of the image will be determined. In this example, the large block of activity is determined as a sample block in the image of one frame.
[0086] If statistics processing is performed by considering the large block of activity as a sample block, the scale factor SF with larger condensation can be found. If compression processing is performed using the scale factor SF, there is an advantage by which the code data of code volume surely smaller than the target code volume CVx is generated.
[0087] Code data is memorized by storages, such as a memory card and a floppy disk. These storages have the limited maximum storage possible capacity, and the code data of the capacity exceeding it cannot be memorized. Since the code data of the code volume exceeding the target code volume CVx is not generated according to this example, code data is surely settled in the capacity of a storage.
[0088] In the above-mentioned sample block decision processing, the amount of code data of all blocks was calculated, and the sample block was determined according to the amount of code data concerned. Next, in order to aim at time amount compaction, it is [no] about blocks, and the amount of code data is calculated only about the primary sample block spatially thinned out mostly in homogeneity, and how to determine a secondary sample block from the inside is explained.
[0089] Drawing 11 is a flow chart which shows the 2nd example of sample block decision processing of the step SA 1 of drawing 7 . At a step SC 1, the amount of code data about a primary sample block is calculated. A primary sample block is a sample block as shown in drawing 12 , and is a sample block by the whole image arranged mostly at homogeneity. The sample block called the thing of the shape of a checker board which shows a primary sample block in drawing 1919 in addition to this, and ******, BEIYA and a swirl is included. As for a primary sample block, the time amount of sample block decision processing becomes short, so that there is little block count.
[0090] In drawing 1 , the sample block decision section 9 directs the image data output of a primary sample block to an image memory 1. It is DCT-processed, and quantizes, image data is encoded, and code data is generated. The sample block decision section 9 counts and memorizes the amount of code data of each block.
[0091] At a step SC 2, a secondary sample block is determined based on the amount of code data of each block concerned, and processing is ended. The block with the amount of code data beyond a predetermined value is used for the decision approach as a secondary sample block like a previous example.

[0092] In addition, the sample with the amount of code data beyond a predetermined value itself is adopted as a sample block, and also the field surrounded with the block concerned can also be considered as a sample block. Drawing 13 (A) The example of a sample block is shown in - (C).
[0093] Drawing 13 (A) shows a sample block when the blocks beyond a predetermined value have gathered in the field under an image. Drawing 13 (B) shows a sample block when the blocks beyond a predetermined value have gathered in the field on the left of an image. Drawing 13 (C) shows a sample block when the blocks beyond a predetermined value have gathered in the field at the lower right of an image.
[0094] In the 1st and 2nd examples of sample block decision processing, the sample block was searched for by performing DCT processing etc. Next, how to search for a sample block by mode assignment is shown, without performing DCT processing etc. According to this approach, since it is not necessary to perform DCT processing etc., a sample block can be determined considerably in a short time.
[0095] Drawing 14 is a flow chart which shows the 3rd example of sample block decision processing of the step SA 1 of drawing 7 . Mode assignment is performed at a step SD 1. The mode shows the class of image and there are scenery mode, person mode, and a text mode. Mode assignment is performed by supplying mode signal MD to the sample block decision section 9 of drawing 1 . Mode signal MD is generated by a user's operating a switch and choosing the mode. A user chooses scenery mode, when photoing scenery, when photoing a person, he chooses person mode, and when photoing a text, he chooses a text mode. A text is a photographic subject copied out on the whole frame at homogeneity.
[0096] At a step SD 2, the class in mode supplied to the sample block decision section 9 is judged. It progresses to a step SD 3 at the time of scenery mode, progresses to a step SD 4 at the time of person mode, and progresses to a step SD 5 at the time of a text mode.
[0097] At a step SD 3, since scenery mode is specified, regardless of the amount of code data, the sample block decision section 9 determines the sample block for scenery unconditionally, and ends processing. The example of a landscape image is shown in drawing 15 (A), and the example of the sample block for scenery is shown in drawing 15 (B).
[0098] At a step SD 4, since person mode is specified, the sample block decision section 9 determines the sample block for persons unconditionally, and ends processing. The example of a portrait image is shown in drawing 1616 (A), and the example of the sample block for persons is shown in drawing 16 (B).
[0099] At a step SD 5, since the text mode is specified, the sample block decision section 9 determines the sample block for texts unconditionally, and ends processing. The example of a text image is shown in drawing 17 (A), and the example of the sample block for texts is shown in drawing 17 (B).
[0100] Next, how to calculate the amount of code data of each block rather than to to perform mode assignment from the exterior, to determine the mode according to the amount of code data concerned, and to determine the sample block in the mode is shown.
[0101] Drawing 18 is a flow chart which shows the 4th example of sample block decision processing of the step SA 1 of drawing 7 . At a step SE 1, the amount of code data about a primary sample block is calculated. The sample block decision section 9 directs the output of the code data of a primary sample block to an image memory 1. Code data is outputted from the coding section 5. The sample block decision section 9 counts and memorizes the amount of code data for every block.
[0102] At a step SE 2, one is chosen from representation sample blocks based on the amount of code data concerned, a sample block is determined, and processing is ended. A representation sample block is for example, the sample block for scenery (drawing 15 (B)), the sample block for persons (drawing 16 (B)), or a sample block for texts (drawing 17 (B)).
[0103] The example which chooses one from representation sample blocks is shown. The amount of code data for every primary sample block is calculated by the step SE 1. In the amount of code data concerned, marking of the block of the thing beyond a predetermined value is carried out. The number with which the location of a block laps between the block and representation sample block which carried out marking is investigated.
[0104] For example, when the blocks which carried out marking have gathered to the field under an

image mostly, many lap blocks arise between the sample blocks for scenery (drawing 15 (B)). On the other hand, when the blocks which carried out marking are scattered all over the whole image, many lap blocks arise between the sample blocks for texts (drawing 17 (B)).
[0105] That with which many blocks of No. 1 lapped in the representation sample block is chosen, and it determines as an actually used sample block. The sample block decision section 9 directs the output of the image data of the sample block concerned to an image memory 1. Then, statistics processing is performed about a sample block.
[0106] In addition, a representation sample block can use the sample block of other patterns besides the sample block for scenery (drawing 15 (B)), the sample block for persons (drawing 16 (B)), or the sample block for texts (drawing 17 (B)).
[0107] Moreover, at a step SE 1, although the amount of code data was calculated only about the primary sample block, the amount of code data may be calculated about a whole block. If the precision of fixed-length-izing of code data is raised in case image data is compressed, in statistics processing, a data compression will be performed many times and a scale factor will be determined. Under the present circumstances, if a data compression is performed about all blocks many times, processing will take long duration. If statistics processing is performed many times using a sample block although a certain amount of time amount is required in order to determine a sample block according to this example, the processing time will be shortened compared with the case where a whole block is used.
[0108] In this example, the large block of activity is detected and the block concerned is considered as a sample block. If the data compression of the large block of activity is carried out, the amount of code data of the block will increase. By considering the large block of activity as a sample block, code data surely fewer than target code volume are generable. When storing code data in the storage with which memory capacity is restricted like a memory card, the technique which generates code data surely fewer than a certain code volume is indispensable, and the effectiveness by this example is large.
[0109] In addition, although this example explained the case where the technique which adopts the large block of activity as a sample block was shown, and the sample block was used for statistics processing, the sample block concerned may be used for other image processings.
[0110] Although this invention was explained in accordance with the example above, this invention is not restricted to these. For example, probably, it will be obvious to this contractor for various modification, amelioration, combination, etc. to be possible.
[0111]
[Effect of the Invention] Since a sample block is determined out of the block which constitutes an image and which carries out a spatial frequency analysis for every block, searches for spatial-frequency distribution of an image, and constitutes an image based on the spatial-frequency distribution according to this invention as explained above, the sample block according to the class of image can be determined.
[0112] Moreover, the pattern of two or more sample blocks is prepared beforehand, and since one is chosen from two or more patterns according to the mode which shows the class of image, a selection decision of the pattern of a sample block according to the mode can be made.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the picture compression structure of a system containing the sample block decision system by the example of this invention.
[Drawing 2] It is drawing showing the matrix of 8x8 showing the DCT multiplier F.
[Drawing 3] It is drawing showing the matrix of the DCT multiplier F generated by carrying out DCT processing of the general image data I.
[Drawing 4] It is drawing showing the example of the quantization table Q.
[Drawing 5] It is drawing showing the quantization data R obtained by quantizing the DCT multiplier F shown in drawing 3 .
[Drawing 6] It is drawing showing how to carry out the zigzag scan of the quantization data R.
[Drawing 7] It is the flow chart which shows the procedure which the picture compression system by this example performs.
[Drawing 8] It is the flow chart which shows the 1st example of sample block decision processing of the step SA 1 of drawing 7 .
[Drawing 9] The two-dimensional image which consists of 3x5 blocks is shown. Drawing 9 R> 9 (A) is drawing showing the example of the amount of code data of each 3x5-block block, and drawing 9 (B) is drawing showing the block adopted as a sample block in 3x5 blocks.
[Drawing 10] The image of the sample block determined about a portrait image is shown. Drawing 10 (A) is drawing showing a portrait image, and drawing 10 (B) is drawing showing the sample block about the portrait image of drawing 10 (A).
[Drawing 11] It is the flow chart which shows the 2nd example of sample block decision processing of the step SA 1 of drawing 7 .
[Drawing 12] It is drawing showing the example of a primary sample block.
[Drawing 13] Drawing 13 (A) is drawing in which a sample block is drawing showing the pattern gathering in the field under an image, and drawing 13 (B) shows the pattern with which sample blocks have gathered in the field on the left of an image, and drawing 13 (C) is drawing showing the pattern with which sample blocks have gathered in the field at the lower right of an image.
[Drawing 14] It is the flow chart which shows the 3rd example of sample block decision processing of the step SA 1 of drawing 7 .
[Drawing 15] Drawing 15 (A) is drawing showing a landscape image, and drawing 1515 (B) is drawing showing the sample block for scenery.
[Drawing 16] Drawing 16 (A) is drawing showing a portrait image, and drawing 1515 (B) is drawing showing the sample block for persons.
[Drawing 17] Drawing 17 (A) is drawing showing a text image, and drawing 15 (B) is drawing showing the sample block for texts.
[Drawing 18] It is the flow chart which shows the 4th example of sample block decision processing of the step SA 1 of drawing 7 .
[Drawing 19] Drawing 19 (A) is drawing showing the whole block pattern of an image, and drawing 19

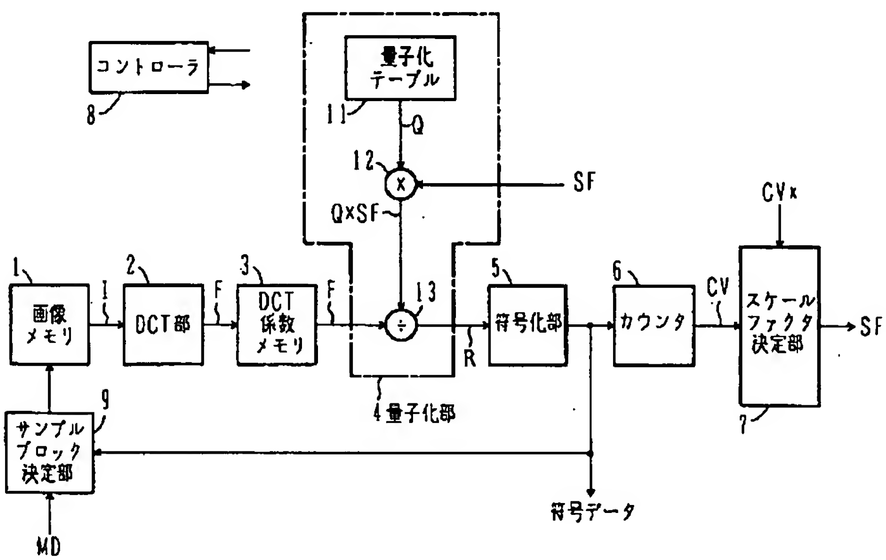
(B) is drawing showing the pattern of a sample block.
[Description of Notations]
1 Image Memory
2 Discrete Cosine Transform (DCT) Section
3 DCT Coefficient Memory
4 Quantization Section
5 Coding Section
6 Counter
7 Scale-Factor Decision Section
8 Controller
9 Sample Block Decision Section
11 Quantization Table Memory
12 Multiplier
13 Divider

[Translation done.]

DRAWINGS

[Drawing 1]

全体構成



[Drawing 2]

DCT係数

高周波成分 →

$$
\text{高周波成分} \downarrow
\begin{pmatrix}
F_{00} & F_{10} & F_{20} & F_{30} & F_{40} & F_{50} & F_{60} & F_{70} \\
F_{01} & F_{11} & F_{21} & F_{31} & F_{41} & F_{51} & F_{61} & F_{71} \\
F_{02} & F_{12} & F_{22} & F_{32} & F_{42} & F_{52} & F_{62} & F_{72} \\
F_{03} & F_{13} & F_{23} & F_{33} & F_{43} & F_{53} & F_{63} & F_{73} \\
F_{04} & F_{14} & F_{24} & F_{34} & F_{44} & F_{54} & F_{64} & F_{74} \\
F_{05} & F_{15} & F_{25} & F_{35} & F_{45} & F_{55} & F_{65} & F_{75} \\
F_{06} & F_{16} & F_{26} & F_{36} & F_{46} & F_{56} & F_{66} & F_{76} \\
F_{07} & F_{17} & F_{27} & F_{37} & F_{47} & F_{57} & F_{67} & F_{77}
\end{pmatrix}
$$

[Drawing 3]

DCT係数

$$\begin{bmatrix} 262 & -13 & -10 & -2 & 27 & 28 & 9 & -45 \\ -38 & -4 & 50 & -8 & -29 & -22 & -12 & -78 \\ -46 & 45 & -6 & 24 & 36 & 54 & -28 & 69 \\ 4 & -5 & 21 & 42 & -2 & 35 & 36 & 92 \\ -64 & 36 & 17 & 33 & 45 & -16 & -16 & -62 \\ 56 & -7 & -9 & -37 & 2 & -31 & 23 & -27 \\ 51 & 7 & 49 & 29 & 18 & -44 & 61 & 8 \\ -63 & 34 & -21 & -17 & 3 & 6 & -1 & -2 \end{bmatrix} \sim F$$

[Drawing 4]

量子化テーブル

$$\begin{bmatrix} 16 & 11 & 10 & 16 & 24 & 40 & 51 & 61 \\ 12 & 12 & 14 & 19 & 26 & 58 & 60 & 55 \\ 14 & 13 & 16 & 24 & 40 & 57 & 69 & 56 \\ 14 & 17 & 22 & 29 & 51 & 87 & 80 & 62 \\ 18 & 22 & 37 & 56 & 68 & 109 & 103 & 77 \\ 24 & 35 & 55 & 64 & 81 & 104 & 113 & 92 \\ 49 & 64 & 78 & 87 & 103 & 121 & 120 & 101 \\ 72 & 92 & 95 & 98 & 112 & 100 & 103 & 99 \end{bmatrix} \sim Q$$

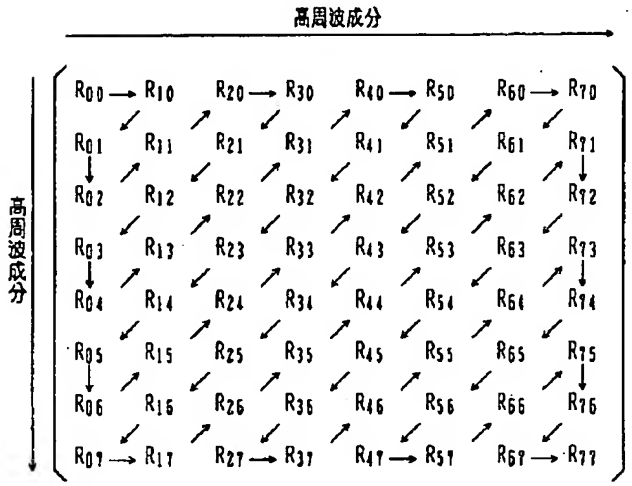
[Drawing 5]

量子化 データ

$$\begin{bmatrix} 16 & -1 & -1 & 0 & 1 & 1 & 0 & -1 \\ -3 & 0 & 4 & 0 & -1 & 0 & 0 & -1 \\ -3 & 3 & 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 1 \\ -4 & 2 & 0 & 1 & 1 & 0 & 0 & -1 \\ 2 & 0 & 0 & -1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \sim R$$

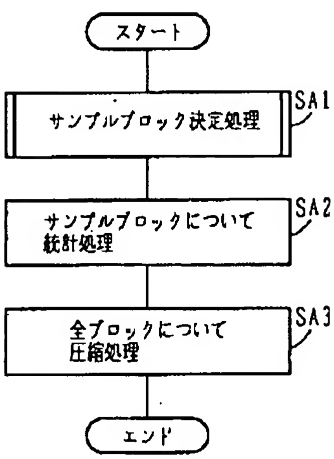
[Drawing 6]

量子化データ



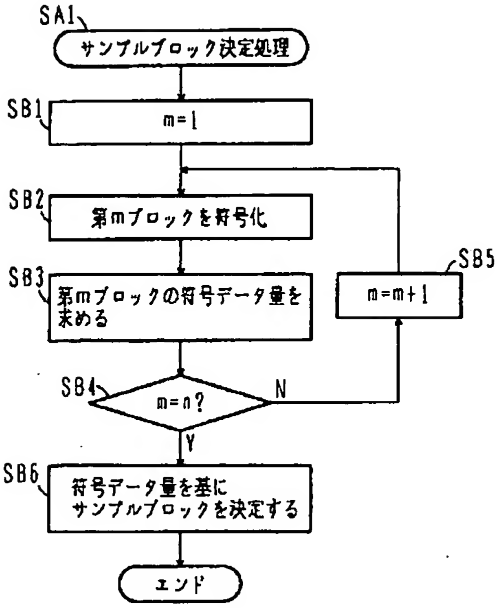
[Drawing 7]

圧縮処理



[Drawing 8]

サンプルブロック決定処理 I

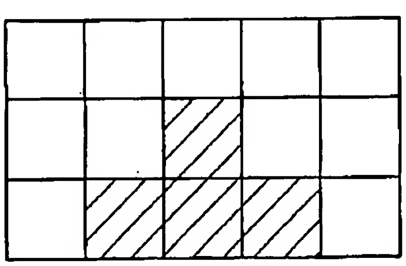


[Drawing 9]

(A) 符号データ量

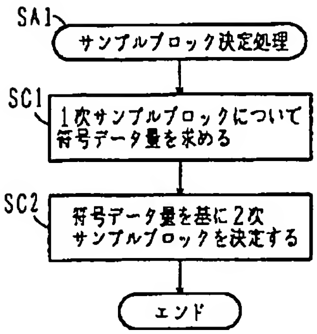
10	20	30	25	10
20	30	130	35	20
30	110	100	120	30

(B) サンプルブロック

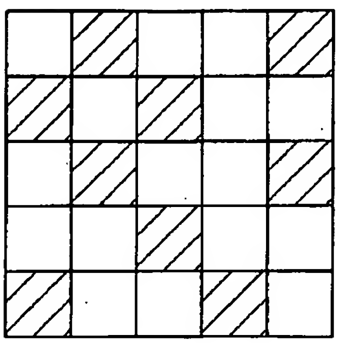


[Drawing 11]

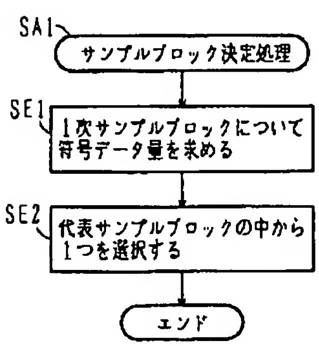
サンプルブロック決定処理Ⅱ



[Drawing 12]
1次サンプルブロック

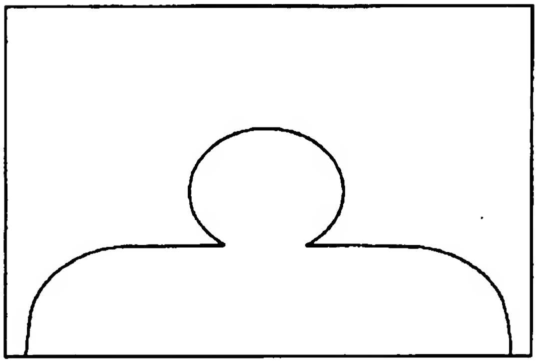


[Drawing 18]
サンプルブロック決定処理Ⅳ

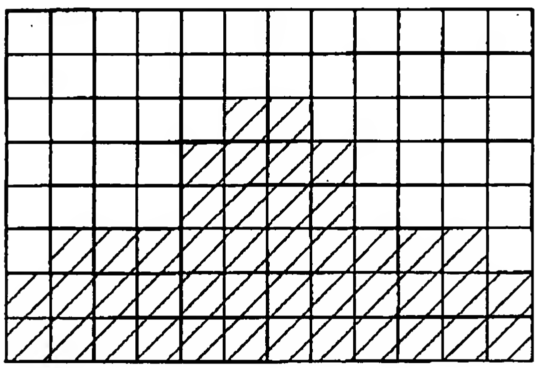


[Drawing 10]

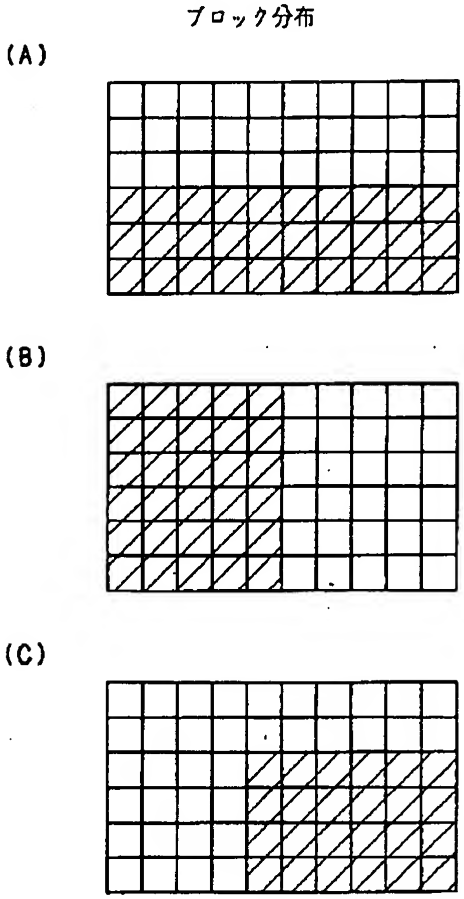
(A) 人物画像



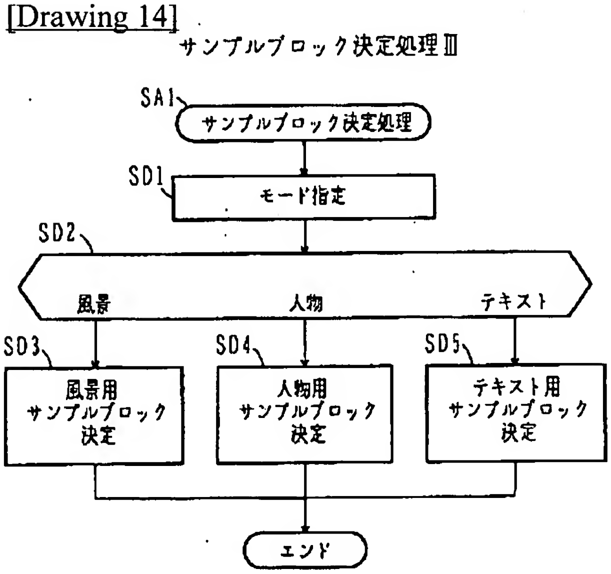
(B) サンプルブロック



[Drawing 13]

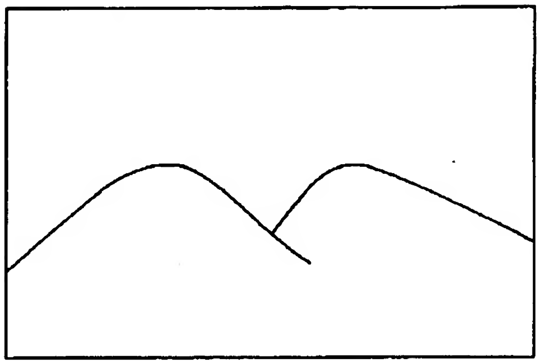


[Drawing 14]

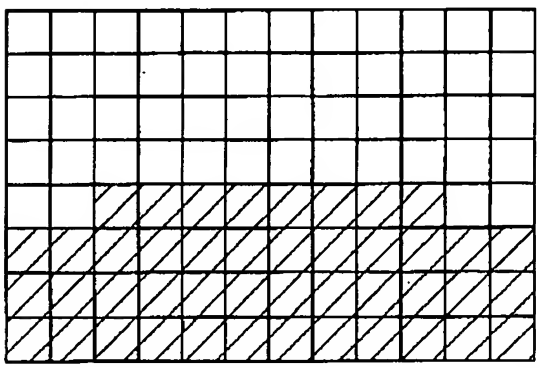


[Drawing 15]

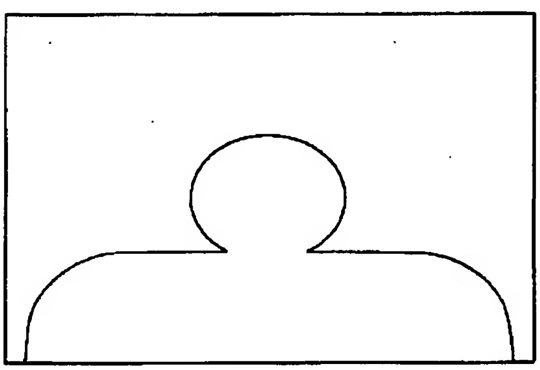
(A) 風景画像



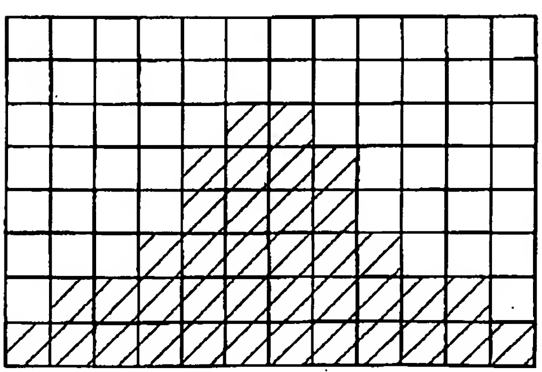
(B) サンプルブロック



[Drawing 16]
(A) 人物画像

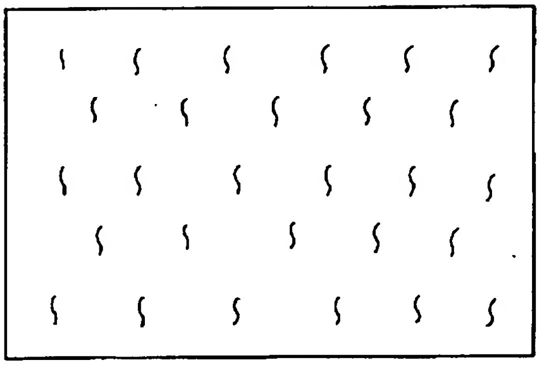


(B) サンプルブロック

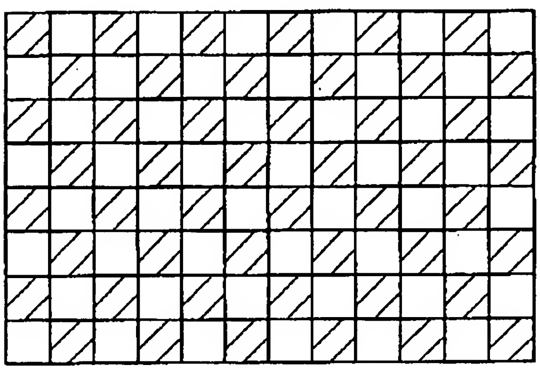


[Drawing 17]

(A) テキスト画像



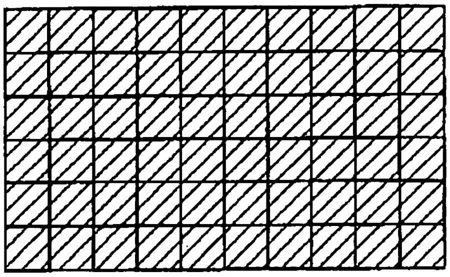
(B) サンプルブロック



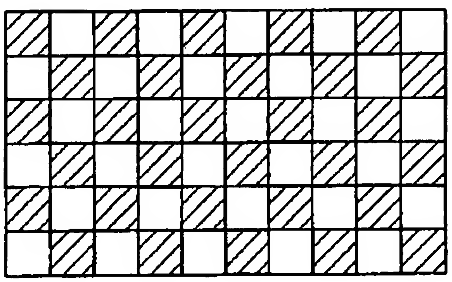
[Drawing 19]

従来技術

(A) 全ブロック



(B) サンプルブロック



[Translation done.]